

Assistance Needed for Elementary Teachers in Texas to Implement Programs of Agricultural Literacy

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Since the publication of Understanding Agriculture: New Directions for Education by the National Research Council, new emphasis has been placed upon the teaching of agriculture to elementary school children. In its report, the Committee on Agricultural Education in Secondary Schools stated, "Agriculture is too important a topic to be taught only to a relatively small percentage of students considering careers in agriculture and pursuing vocational agriculture studies" (National Research Council, 1988, p. 1).

Currently, only 4.5% of the high school students in the United States enroll in agriculture classes. The committee recommended that agricultural education programs expand to reach a greater number of students. One of the major conclusions of the National Research Council study was that, "Beginning in kindergarten and continuing through twelfth grade, all students should receive some systematic instruction about agriculture" (p. 2).

Results of recent research further reinforce the need for expanding the scope of agricultural education. Horn and Vining (1986) found that school age children in Kansas knew little about the food and fiber system. Adults in Arizona were found to have limited knowledge and poor perceptions of agriculture (Behavior Research Center of Phoenix, 1989).

The emphasis placed on education about agriculture for children of all ages as recommended by the Committee on Agricultural Education in Secondary Schools is not original. Philosophers such as Socrates, Pestalozzi, and Comenius all believed that, early in life, people should learn about plants, animals, and the ways humans use them (Snowden & Shoemaker, 1973). Human development theories formulated by Freud, Erikson, and Piaget suggest that between the ages of six years and eleven years children develop opinions and ideas that last throughout their life. They also believed that this same approximate age range is appropriate for children to learn about their environment and society (Davis, 1983). Thus, it would be appropriate to introduce agriculture, with its many applications and concrete examples, to children in the upper grades of elementary school.

Many materials designed to teach children about agriculture have been developed by a variety of groups. Several governmental agencies, agricultural businesses, agricultural organizations, and environmental groups have developed materials covering a vast array of subjects related to agriculture. In spite of this variety of materials and sources, a common thread does exist; it is generally agreed that the best way to deliver programs of agricultural literacy is by integrating agricultural topics into the curriculum of established disciplines (Everett, 1985; McReynolds, 1985; National Research Council, 1988). The role of the elementary school teacher has become very important.

Drake (1990) pointed out that the success of any program intended to teach children about agriculture depends upon the ability of the teacher. Considering the fact that Swan and Donaldson (1970), as well as Bowers and Kohl (1986) found that elementary school teachers rate their knowledge of agriculture as low, the need for some type of program to help teachers teach about agriculture is apparent.

Oliver (1986) concluded that elementary teachers would not be able to apply agricultural concepts in their teaching effectively without training or assistance of some kind. However, little was known about the focus of such programs or the type of program format preferred by teachers.

Purposes and Objectives

The purposes of this study were to assess fourth grade teachers' understanding and use of agricultural concepts in their teaching and to determine if assistance is needed to help teachers implement programs of agricultural literacy in the classes they teach. The objectives developed to accomplish these purposes were to:

Identify selected personal and professional characteristics of fourth grade teachers.

Determine the teachers' knowledge of agriculture.

Determine the teachers' perceptions of agriculture.

Determine the extent teachers teach about agriculture and use materials, resources, projects, and programs that involve agricultural concepts.

Identify the type and degree of assistance that teachers would be most interested in to supplement their skills in teaching agriculture and agricultural concepts.

Examine the relationships between and among the following: personal and professional characteristics, knowledge of agriculture, perceptions of agriculture, extent of teaching agriculture, use of agricultural concepts in teaching, and types of assistance preferred.

Procedures

Population and Sample

The population of this study was fourth grade teachers in Texas during the 1989-1990 school year. The researchers selected fourth grade teachers because that is the grade level in which science and social studies are to be introduced to children in Texas public schools (Texas Education Agency, 1987).

Due to the lack of a state roster of fourth grade teachers, the population size was estimated using procedures recommended by the Texas Education Agency. The group was found to include approximately 11,626 fourth grade teachers at 4140 schools. Because there was no home mailing list for these teachers, a cluster sampling technique was used to select a random sample. According to Borg and Gall (1983), in cluster sampling the unit of random sampling is the naturally occurring group of individuals, in this case the school. Three-hundred schools were randomly selected to participate in the study and all fourth grade teachers at each of the sample schools were to take part. This procedure was expected to yield a sample of about 800 fourth grade teachers, more than twice the sample size recommended for a population exceeding 10,000 (Ott, 1986).

Instrumentation

The instrument used to collect the data of this study was a mailed questionnaire containing 97 items divided into five parts. Part I contained eight open-ended questions pertaining to personal and professional characteristics. Part II was used to determine the teachers' perceptions of agriculture and was composed of a single open-ended question -- "What is agriculture?" This method was similar to one used by Orthel, Sorensen, Shannan, and Reisenberg (1989) in their study of secondary students' perception of agriculture. Part III was made up of 25 multiple choice items designed to measure knowledge of agriculture. Part IV was composed of questions to identify aspects of agriculture taught and resources used to teach agriculture. Part V contained nine questions addressing assistance programs using a five point, Likert-type scale. The choices were: Very Interested = 5, Interested = 4, Somewhat Interested = 3, Not interested = 2, and Definitely Not Interested = 1.

The validity and reliability of the instrument were determined using a variety of techniques. Content and face validity were determined by a panel of experts consisting of 14 faculty members and graduate students from the College of Agriculture and Life Sciences and the College of Education at Texas A&M University. A pilot test using fourth grade teachers from five schools not included in the sample was also used in this process. Cronbach's alpha was used to determine reliability on appropriate parts of the questionnaire. The alphas were: Part III, .57; Part IV, .89; Part V, .88. A special note should be made of the low reliability of Part III. The problems with that portion of the questionnaire were recognized following the pilot test. Some questions were re-written or re-designed. Five of the twenty-five questions included in the questionnaire were not used in the analysis of the data. The researchers recognize that the alpha for Part III remains low, however, Nunnally (1976) suggested that a reliability of .50 or .60 will suffice in the early stages of research on predictor tests.

Data Collection

Due to the nature of the sampling procedure, the principal at each sample school was contacted and asked to coordinate the collection of data at his/her school building. Three follow-up notes were sent, and 70% (210/300) of the principals agreed to assist in this phase of the study.

Beginning November 15, 1989, a total of 900 questionnaires were sent to the cooperating schools. Up to three follow-up notes were sent until the completed questionnaires had been returned culminating in a response rate of 57% (510/900). Close analysis of the respondents revealed that they adequately represented all geographical areas of Texas and a cross section of community and school sizes and thus reflected randomization. Further, according to Goldhor (1972), nonrespondents are assumed to be similar to late respondents. In this study no differences were found between early and late respondents and the results of this study were generalized to the population.

Analysis of Data

Descriptive statistics were used to describe the teachers' personal and professional characteristics, knowledge of agriculture, perceptions of agriculture, teaching of agriculture, and type of assistance preferred. Pearson product moment, t-tests, and analysis of variance (ANOVA) were used to measure relationships between and among the variables.

The conventions used for describing relationships between and among variables were as follows: .70 or higher equaled very strong association; .50 to .69 equaled substantial association; .30 to .49 equaled moderate association; .10 to .29 equaled low association; and .01 to .09 equaled negligible association (Davis, 1971). With t-tests and ANOVA, an alpha level of $p < .05$ was used to detect statistical significance.

Results

Personal and Professional Characteristics

The 510 fourth grade teachers represented cities in all geographic areas of Texas. Seven percent of the teachers worked in communities with populations of less than 1000; 25% in cities of 1000 to 9999 people; 40% in cities of 10,000 to 99,999; and 28% in cities with populations over 100,000. Teaching experience of the group ranged from one to 44 years with a mean of slightly more than 12 years.

The personal characteristics of teachers included the following information: 32% of the teachers indicated that they had lived on a farm or ranch for at least one year beyond their eighth birthday; 26% stated that at some time in their life, they or their family had derived a major portion of their income from agriculture; 24% had been members of a 4-H club; only 4% had been FFA members and students of vocational agriculture; and 4% had taken one or more agriculture classes in college.

Knowledge of Agriculture

The teachers' scores on the test of knowledge about agriculture ranged from 5% (1/20) to 89% (17/20) with a mean of 48.4 %. The scores were classified using a grade scale format generally accepted in academic settings. The labels for the scale were modified for this particular test and are listed below:

90% - 100%	Superior knowledge
80% - 89%	Acceptable knowledge
70% - 79%	Moderate knowledge
60% - 69%	Minimal knowledge
Less than 60%	Unacceptably low knowledge

As shown in Figure 1, nearly three-fourths of the respondents had a score indicating unacceptably low knowledge about agriculture.

More than 70% of the teachers know that George Washington Carver developed a variety of products from peanuts; mechanization was the primary reason for increasing agricultural yields in the first half of this century; laying hens produce about 240 eggs per year; and veal is the meat of young cattle. Fewer than 25% of the group knew that Americans spend just 12% of their income on food or that poultry is the most highly integrated industry in agriculture. Fewer than 15% of the teachers were aware that one United States farmer produces enough food for about 75 people or that the commodity futures market permits producers to reduce risk through price protection.

Perceptions of Agriculture

The teachers responses to the question, "What is agriculture?" were reviewed by the researchers and classified into one of two categories: 1) agriculture is farming and ranching only, or 2) agriculture is more than farming and ranching. Responses from over 90% of the teachers were classified in the category, "Agriculture is farming and ranching only." Some teachers answered the question with one word response, "farming." Although other answers were more verbose, most teachers associated the term "agriculture" only with the raising of plants and animals.

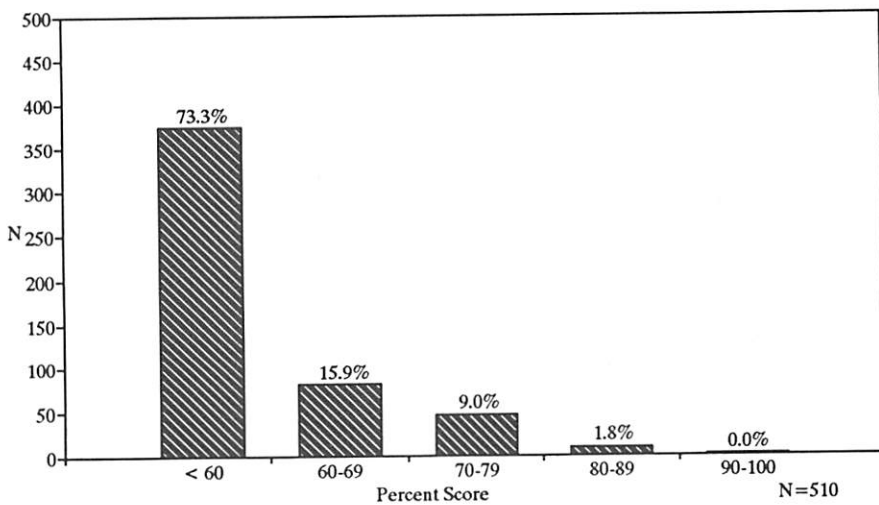


Figure 1. Teachers' scores on test of knowledge about agriculture.

Teaching of Agriculture

When asked about the number of hours they teach agriculture, 75% of the teachers said that they taught the subject at least one hour per year. The average for the group was over 16 hours per year, but the median was 8 hours per year. Eleven teachers said that they taught agriculture 100 hours or more per year. These data are illustrated in Figure 2.

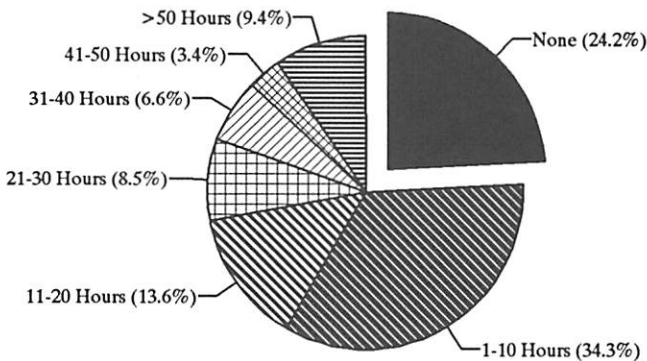


Figure 2. Hours spent teaching about agriculture per year.

Teachers responded to questions soliciting specific information about their teaching of topics related to agriculture. The seven most commonly taught topics related to agriculture and the frequency and percent of the teachers who indicated that they teach each topic are displayed in Table 1. Five percent of the teachers responded that they did not teach any of the topics listed on the questionnaire while six percent indicated that they taught all 14 of the agricultural topics listed.

Table 1. Teaching of Agricultural Topics (N=510)

Topic	N	%
Sources of our food	440	87
Nutrition and proper food selection	427	85
Ecology and environmental management	395	78
Plant growth and development	391	77
Wildlife	389	77
Insects	324	64
Agriculture in our history	287	57

The instrument included 18 sources of materials that might be used in teaching agricultural topics. In Table 2, the number and percent of teachers who indicated they use selected material are shown, along with the rank of the item. The table displays the five most commonly used sources along with information about Ag in the Classroom and Food for America. Fourteen percent of the teachers used none of the materials listed on the instrument. The most used source was chapters about agriculture in textbooks (71%). Ag in the Classroom and Food for America, materials that have received praise from the agricultural education community, were used by 11% and 5% of the teachers, respectively. The median number of material sources used by teachers was two.

Table 2. Sources of agricultural teaching materials used (N=510)

Sources of materials	Frequency	Percent	Rank
Textbook chapters about agriculture	359	71	1
Articles about agriculture in newspapers and/or magazines	265	53	2
Dairy associations or groups	173	34	3
United States Department of Agriculture	118	23	4
Environmental groups	88	17	5
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Ag in the Classroom	56	11	8
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Food for America	23	5	16

The teachers were asked to indicate what agricultural professionals they used as resource persons to assist them with their teaching of agriculture. Sixty-eight percent of the teachers stated that they did not use any of the professionals listed. The most commonly used agricultural resource persons were agricultural producers (18%), followed by extension agents (17%), and agribusiness persons (8%). Rounding out the list were high school agriculture science teachers (6%), agriculture faculty from a college or university (4%), and state extension specialists (2%).

Respondents were to indicate the types of teaching/learning projects they use to teach about agriculture. The most used project related to agriculture was growing of plants, which was used by over three-fourths of the teachers. Other popular projects included fish or other aquarium animals and plants (35%) and insect projects such as ant farms and bee hives (35%). Eighty-two percent of the teachers used at least one of the ten projects included in the instrument.

Programs such as taking students on field trips to agricultural expositions and field trips to agricultural businesses were participated in by 15% of the teachers. Only seven percent stated that their classes participated in Food For America or some other

program conducted by the local FFA chapter or high school agricultural science department.

The results of this portion of the study also indicated some disparity in the teachers' knowledge about and/or perceptions of agriculture. While nearly 25% of the teachers said they taught agriculture zero hours per year, less than three percent indicated that they taught none of the topics related to agriculture, used none of the sources of agriculture teaching materials, or conducted none of the projects of programs related to agriculture. More than 97% of the respondents taught about agriculture or used agricultural concepts in their teaching.

Types of Assistance Preferred

The teachers were asked to indicate the types of programs they would prefer to assist them in their efforts to teach their students about agriculture. The percent responding to each level of interest and the mean level of interests of the teachers' responses are presented in Table 3. The respondents were most interested in the least structured programs that would allow them to work on their own. Of the more highly structured activities, the teachers preferred short workshops to long ones. On the other hand, of the graduate classes for credit, the teachers preferred the longer, three credit course to the courses in which they would earn fewer credits.

Table 3. Level of interest in assistance programs expressed in percentages

Program	1*	2	3	4	5	Mean	SD
List of materials currently available	4.0	5.0	7.0	21.1	62.8	3.44	1.31
List of references for personal reading and research	5.0	10.8	21.1	25.0	38.1	2.80	1.12
Consult local agricultural professionals	7.2	17.7	27.4	25.6	22.1	2.38	1.02
1 - 2 day noncredit workshop	18.8	25.6	22.7	21.2	12.7	1.83	1.17
3 credit graduate course	25.3	27.3	17.6	17.4	12.4	1.64	1.18
1 credit graduate course	26.8	33.2	20.6	14.0	5.4	1.38	1.35
2 credit graduate course	27.1	33.7	18.2	16.2	4.8	1.38	1.07
1 week noncredit workshop	31.3	39.5	11.9	13.9	3.4	1.19	1.19
2 week noncredit workshop	41.6	39.0	7.8	10.0	1.6	0.91	1.21

*1 = definitely not interested; 2 = not interested; 3 = somewhat interested; 4 = interested; 5 = very interested.

Relationships Between and Among Variables

Using the Pearson product-moment procedure, only negligible to low correlations were found to exist between various personal and professional characteristics and the other variables. In addition, no correlation over .19 existed between the teachers' score on the test of knowledge about agriculture or their perception of agriculture and any of the other variables. Moderate to substantial associations existed between variables such as total topics taught and hours spent teaching agriculture, number of materials used and number of resource persons used, and number of projects used and number of programs in which teachers participated.

ranch for at least one year beyond their eighth birthday and those who did not. Teachers with the farm and/or ranch background had more experience in vocational agriculture classes, more years in 4-H clubs, and more teaching experience. In addition, this same group scored higher on the test of knowledge about agriculture, taught agriculture more hours during the year, taught more agricultural topics, used more agricultural professionals as resource persons, and had their classes participate in more programs related to agriculture. The specific topics that they taught more than the teachers who had not lived on a farm or ranch beyond their eighth birthday included: 1) farm animals; 2) agriculture in our history; 3) agricultural careers; 4) gardening; and 5) role of agriculture in our economy.

Significant differences were detected based on other personal and professional characteristics. Teachers who had taken agriculture courses in college had a significantly higher score on the test of knowledge about agriculture, a more accurate perception of agriculture, and used more agricultural professionals as resource people than did their counterparts who had not taken at least one agriculture course in college. Likewise, teachers with 4-H experience scored higher on the test of agricultural knowledge than did those teachers who did not participate in 4-H activities. They also used more resource persons, materials, and projects in their teaching of agriculture.

Significant differences were also found between teachers with five or fewer years of teaching experience and those with more than five years in the classroom. The more experienced teachers had a greater tendency to come from families that earn or had earned a major source of their income from agriculture. They scored higher on the test of knowledge about agriculture. The younger teachers, on the other hand, were more interested in getting assistance in their teaching of agriculture by taking graduate courses worth two or three credits.

Conclusions and Recommendations

The data indicated that the majority of teachers in Texas are teaching agriculture and agricultural concepts to their students. It is apparent that these teachers have inaccurate perceptions and limited knowledge of agriculture. In agreement with the recommendations of the Committee on Agricultural Education in Secondary Schools (1988), the researchers contend that efforts should be made to improve teachers' perceptions and increase their technical knowledge of agriculture to enhance their teaching of agricultural concepts.

The teachers with experience in some type of agriculture course or program had more accurate perceptions and greater knowledge of agriculture. In addition, these teachers used a greater number of resources to teach agriculture. These conclusions suggest that the teaching of agriculture in elementary schools could be promoted by providing teachers with opportunities to take courses in agriculture during their training in college.

The resources most used by fourth grade teachers in Texas for teaching about agriculture were chapters related to agriculture in textbooks. Agricultural educators should work to improve and expand such textbook units to increase the teaching of agriculture to elementary school children as opposed to developing separate materials for this purpose.

As the Committee on Agricultural Education in Secondary Schools (1988) found, "Virtually no effort is made anywhere to educate teachers about agriculture, except for the teacher education programs designed for vocational agriculture teachers" (p. 15). The results of this study indicate that a variety of assistance programs should be promoted. A great number of fourth grade teachers in Texas are interested in receiving a list of materials and other resources to assist them in teaching about agriculture. While such lists have been developed, their availability must be increased. In addition, short in-service workshops and graduate courses for three credit hours should be developed to assist and encourage teachers in their efforts to teach about agriculture.

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